

Sessions 1 and 2

Making Fair Shares

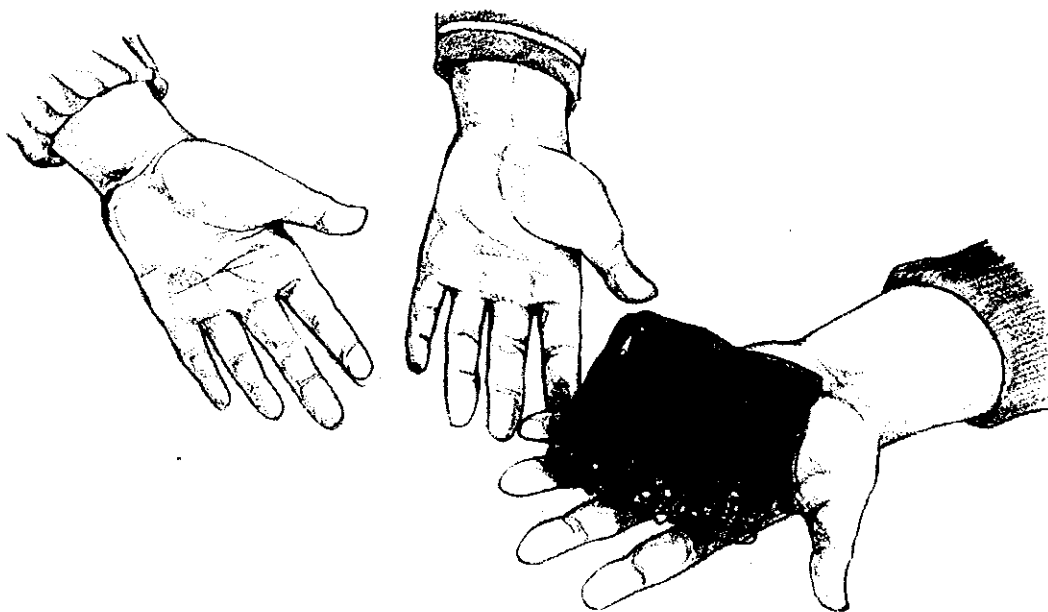
Materials

- Large Brownies on colored paper (1 per student)
- Rulers, glue sticks, tape (1 per pair)
- Scissors (1 per student)
- Student Sheet 1 (1 per student)
- Student Sheet 2 (1 per student)
- Transparency of Student Sheet 2
- Overhead projector
- Letter-size sheets in different colors (6 of one color per student, class; 5 of another color per student, homework)
- Colored pencils or markers
- Envelopes or resealable plastic bags (1 per student)
- Chart paper
- Family letter
- How to Make Fraction Cards (1 per student, homework)

What Happens

Students cut up paper rectangles as if they were brownies to share equally among a number of people. They show ways to share one brownie equally among 2 people, 4 people, 8 people, 3 people, and 6 people. They explore these same fractions by folding paper to make a set of Fraction Cards. They start to develop a class list of fraction facts. Their work focuses on:

- understanding that fractions are equal parts
- partitioning area into equal parts
- making a list of fraction facts



Activity

One Brownie to Share

Hand out the Large Brownies sheet, copied on a mix of colored paper, one to each student, along with rulers, scissors, and glue sticks. Students cut on the dotted lines to make rectangular “brownies.” Have neighbors exchange some of their brownies for ones in different colors so that they can use a different color for each sharing in this activity.

As students finish cutting out their brownies, distribute Student Sheet 1, *Sharing One Brownie* (two pages).

Pretend each rectangle you cut out is one brownie. How can you cut your brownies to make equal shares? Use only straight lines or straight cuts as if you were cutting your brownies with a knife.

Students cut three “brownies” (rectangles) into equal shares as called for on the first page of the student sheet—one into 2 shares, one into 4 shares, and one into 8 shares. Then they paste the pieces of their cut-apart brownies on the student sheet.

While students are working, ask them to prove to you that all the shares of any given brownie are equal. Students may make equal shares that are rectangles or triangles. Partners might collaborate to try different ways of cutting up the brownies (for example, by cutting on the diagonal rather than on a vertical line).

Students exchange their work with a partner to check that they have equal halves, fourths, and eighths.

Now cut two more brownies into equal shares, again using straight lines. This time make 3 and 6 equal shares.

Students continue by cutting brownie rectangles into thirds and sixths and pasting the pieces on the second page of the student sheet.

Collect the unused large brownie rectangles, or let students save them for use in the Teacher Checkpoint activity at the end of this session.


Name _____ Date _____

Student Sheet 1


Sharing One Brownie (page 1 of 2)

Cut up large brownie rectangles and glue the pieces below. Show how you would make fair shares.

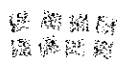
1. 2 people share a brownie. Each person gets $\frac{1}{2}$



2. 4 people share a brownie. Each person gets $\frac{1}{4}$



3. 8 people share a brownie. Each person gets $\frac{1}{8}$




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Name _____ Date _____


Student Sheet 1

Sharing One Brownie (page 2 of 2)

4. 3 people share a brownie. Each person gets $\frac{1}{3}$



5. 6 people share a brownie. Each person gets $\frac{1}{6}$



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Activity

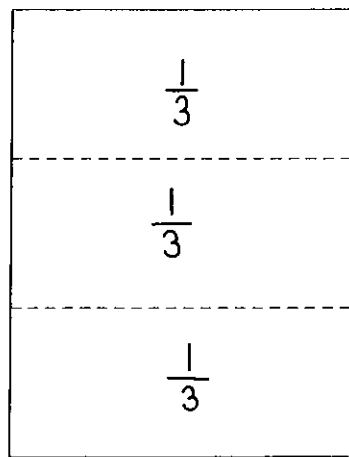
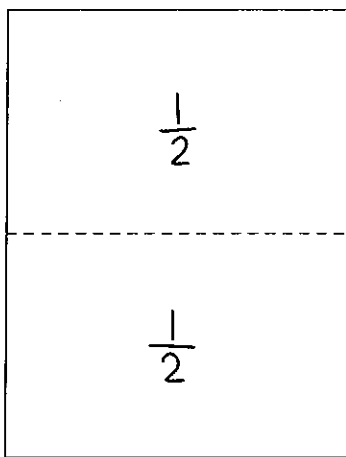
Making Fraction Cards

Give each student five sheets of the same color letter-size paper. This way, students working together can keep their sets separate. Explain that they will be using these sheets to make Fraction Cards. Then demonstrate the process. Fold a piece of paper in half, and mark the fold line with a marker. While you are doing this, ask students:

How many equal pieces am I making? Now you do the same with one of your sheets.

What fraction is each part?

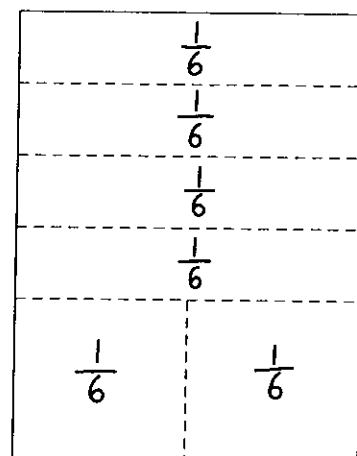
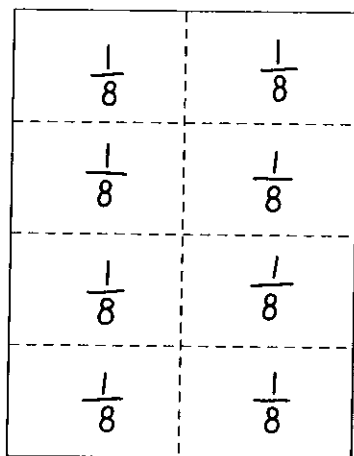
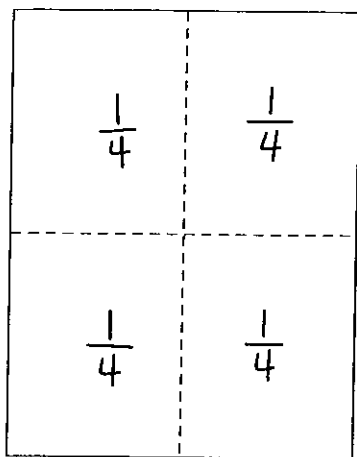
Students fold one of their sheets in half, the same way you did, to show the two equal pieces. Demonstrate fraction notation for students by writing $\frac{1}{2}$ in large numbers on each half of your model. (The back of the sheet is blank; be sure the numbers don't show through from the front.) Post the sheet on the board with the labels showing. **Note:** To make it easier to recognize "top" and "bottom" numbers, write all fractions that students will see with the numerator directly above the denominator, and with the divide line horizontal rather than diagonal.



Fold a second sheet of paper into three equal parts, as if folding a letter to fit in an envelope. Mark the fold lines with a marker. Students also fold a sheet in this way. This task will be difficult for many students. Allow time for them to help one another. You might take your sheet around to measure with and mark on the edges of students' sheets where the folds should be. Students who can fold thirds accurately can fold sheets for other students and make extras for students to use later in folding sixths.

When students each have a sheet folded in three parts, ask them what fraction each part is and how they think you should write it. When the class agrees that each piece is one-third, or one out of three, label the sections of your sheet with $\frac{1}{3}$. Students do the same on their sheets.

Using the same process, but also making one vertical fold down the middle, make sheets of fourths and eighths, folding and labeling so that everyone can see. Each time, students fold their sheets as you do (using one sheet for fourths and one for eighths) and agree as a class about what fraction to write on each of the parts.



To make sixths, start by folding the sheet as you did for thirds. You may want to cut the thirds apart first, then make sixths by dividing them as follows: Fold *two* of the thirds in half with a lengthwise fold, making four long skinny strips. Fold the *other* third in half the short way, making two chunkier sixths. (The long strips make it easier to combine sixths with halves when making a whole.) Label each of the parts.

Students now have sheets folded and marked into halves, thirds, fourths, sixths, and eighths. They cut these apart on the marked lines to make their set of Fraction Cards. Distribute envelopes or resealable plastic bags to keep them in. Students will use the Fraction Cards in Ten-Minute Math. They will later make a second set at home for the Fraction Card game.

Skinny and Chunky Sixths Plan to spend some extra time discussing the different shapes they made for the sixths cards.

Are all six pieces, including the skinny ones and the chunky ones, the same size? How can we check to see if all the sixths are the same size?

Students work alone or in pairs. They may need to fold and cut their sixths to determine the answer. After a few minutes, some students may notice that if they cut the skinny sixth in half, the two pieces can be stacked to cover the chunky sixth exactly. Or they can cut the chunkier sixth in half and put the pieces end to end to cover the skinny sixth. One or two students can demonstrate their solutions to the class.

After cutting some of their sixths to prove that different-sized pieces have equal areas, students can tape them together again or make new sixths to be sure they end up with complete sets of Fraction Cards.

Activity

From Smallest to Largest

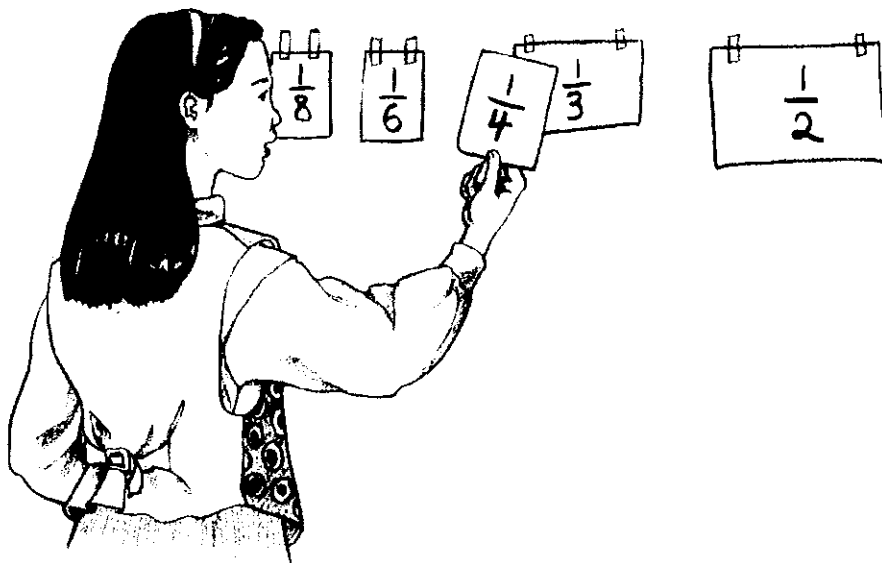
From the Fraction Cards you made in the preceding activity, select one of each size (use one of the chunky sixths). Spread your cards in random order, turned over so that students cannot see the fractions written on them. Place them within student reach—you might tape them on the board or tack them on a bulletin board.

I want to order these fractions from smallest to largest, with the smallest over here (to the left) and the largest over here (to the right).

Invite volunteers to rearrange the cards, moving one at a time, until the cards are arranged in order from smallest to largest.

Ask if anyone is not entirely sure the cards are in the correct order by size. Students who are uncertain may come up and check by placing one card on top of another to compare them directly. Sometimes the difference between sixths and eighths is difficult to see without a close inspection. When the class is sure that the cards are in order, ask students to try to name the fraction each card represents.

When students have guessed the names of the fractions, turn the cards over one by one to reveal the fraction. Students may notice a number pattern—each larger fraction has a smaller denominator than the one before—and use it to check that the cards are in order from smallest to largest.



Activity

Finding Fraction Facts

Begin a class list of fraction facts on chart paper. You might start two lists—one for the family of fraction facts using halves, fourths, and eighths, and another for the fraction facts using halves, thirds, and sixths.

What are some things you have noticed about fractions?

How can you combine two fractions to make a new fraction? How can you cut a fraction to make new fractions?

Here is a chance to introduce the conventional symbols for fractions with numerators larger than 1, as well as a chance to add fractions. Listen to your students' suggestions and write them using conventional notation. Present these notations not as the *only* correct way to write fractions, but as common usage. Be sure to write some of the students' suggestions in words; for example, "one-fourth is half of a half" or "four-eighths make a half."

Halves, Fourths, Eighths

$$\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$$

8 eighths make a whole

Halves, Thirds, Sixths

$$\frac{1}{3} + \frac{1}{3} + \frac{1}{3} = 1$$

A sixth is half of a third

$$\frac{2}{3} = \frac{4}{6}$$

Third grade students are accustomed to using the equal sign only to point to an answer to a problem, not more generally to join two equal things. For example, they might be comfortable with $\frac{1}{4} + \frac{1}{4} = \frac{1}{2}$, but not with $\frac{2}{4} = \frac{1}{2}$. Give them time to talk about this difference. Introduce the equal sign as a way to join equal things. Encourage students to invent fraction sentences that join equal amounts in a variety of arrangements. For example:

$$\frac{2}{4} = \frac{1}{2}$$

$$\frac{1}{2} = \frac{1}{4} + \frac{1}{4}$$

$$\frac{1}{2} + \frac{1}{4} + \frac{1}{4} = \frac{1}{2} + \frac{1}{2}$$

$$\frac{1}{4} = \frac{1}{2} \text{ of } \frac{1}{2}$$

$$\frac{3}{3} = \frac{1}{3} + \frac{1}{3} + \frac{1}{3}$$

$$\frac{6}{6} = 1 = \frac{3}{3} = \frac{4}{4} = \frac{8}{8}$$

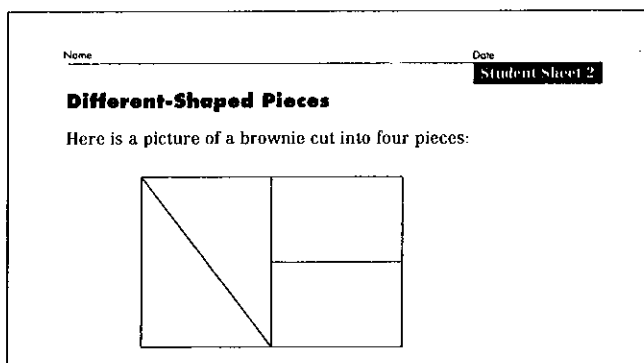
You will want to keep these lists posted throughout the unit. Students will add to the lists in future sessions as they discover new relationships among fractions. In Investigation 2, Pattern-Block Cookies, students will find more relationships among halves, thirds, and sixths.

Activity

Teacher Checkpoint

Different-Shaped Pieces

Use Student Sheet 2, Different-Shaped Pieces, to check whether students understand equality of area.



Looking at the above diagram of a paper brownie, students complete the statement “I believe that the rectangle pieces and the triangle pieces are/are not the same size because _____.” Students can cut and paste their own large paper brownies (using those left from earlier in the session) to see if the shapes are the same size. For help in evaluating students’ work, see the **Teacher Note**, Different Shapes, Equal Pieces (p. 12).

After students have completed the checkpoint, put a transparency of Student Sheet 2 on the overhead or draw the picture of the brownie rectangle on the board. Invite volunteers to show everyone how they know that the triangle is the same size as the rectangle. They might draw their ideas on the board or show the pieces of their cut-up brownie on the overhead projector.

If some students still don’t believe the shapes are the same area, give them a right triangle (which you can make by folding and cutting a piece of paper on a diagonal) for them to cut and rearrange to make a rectangle.

Sessions 1 and 2 Follow-Up



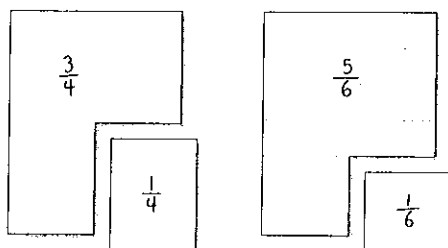
Homework

How to Make Fraction Cards Send home the family letter (p. 66) or *Investigations* at Home. Students also take home a copy of How to Make Fraction Cards and five sheets of colored paper (if possible) to make a second set of cards. Ideally, the second set should be a different color from the first set they made in class. Students can use this set of Fraction Cards at home throughout the unit. In Investigation 2, they will learn a fraction game they can play at home with their two sets of cards.

Ordering Larger Fractions Make another set of Fraction Cards, modified as follows:



Fold and mark each sheet as directed in Making Fraction Cards (p. 6), but before writing any labels, cut out one of the fractional parts of each sheet (cut out one of the chunky sixths). Label this part with its fraction ($\frac{1}{2}$, $\frac{1}{3}$, $\frac{1}{4}$, $\frac{1}{6}$, $\frac{1}{8}$), and label what remains of each large piece with its fraction ($\frac{1}{2}$, $\frac{2}{3}$, $\frac{3}{4}$, $\frac{5}{6}$, $\frac{7}{8}$).



With student help, display all of the fraction pieces, both large and small, in order. Give students a minute to look for patterns among these ordered fractions; then cover the pieces or turn them so the labels don't show and ask students what they noticed. You might ask a few questions:

Which fractions are larger than $\frac{1}{2}$? Which are smaller than $\frac{1}{2}$?

Which is larger, $\frac{5}{6}$ or $\frac{3}{4}$? Each is missing one piece—why aren't they the same size?

Uncover the fraction labels and ask students to say more about what they notice about the ordered pieces.

